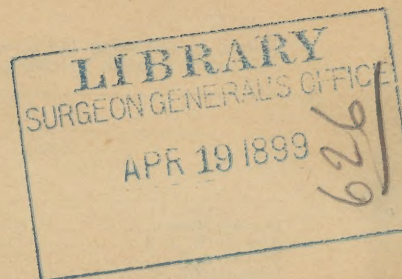


Phillips (W. F. R.)

SUNSTROKE WEATHER OF AUGUST, 1896.*



By W. F. R. PHILLIPS, M. D., in charge of the Section of Climatology.

The abnormal heat that prevailed over the eastern two-thirds of the United States during the last few days of July, and the first fifteen days of August, 1896, suggested to the Chief of the Weather Bureau, the propriety of studying the subject of sunstroke, in so far as it is connected with and dependent upon meteorologic conditions.

With this object in view he directed that the following circular, asking for information, be sent to different hospitals located in the affected region, and also to others from whom useful information might be secured.

U. S. DEPARTMENT OF AGRICULTURE,
WEATHER BUREAU,
Washington, D. C., August 20, 1896.

The large number of casualties reported by the newspaper press as attributed directly to the effects of the recent hot spell of weather that prevailed extensively over the country, especially the eastern part, has suggested to the Weather Bureau the propriety of studying the subject of sunstroke in so far as it is connected with and dependent upon the meteorologic conditions, in order that the weather forecasts issued by the Bureau may, if possible, be given an additional general value.

With this object in view, the Bureau would request those into whose hands this circular may come to give the information, if any, in their possession, provided for in the subjoined blank as completely as practicable, and to return the same in the addressed franked envelope, herewith inclosed.

Should the results of the contemplated investigation be deemed of sufficient value, they will be published for public distribution.

WILLIS L. MOORE,
Chief of Bureau, and Acting Secretary of Agriculture.

The information obtained seemed to be of such importance that he gave specific instructions to the writer to make compilation and study of the same, with the result as herein stated.

In this paper and the accompanying statistical tables the term sunstroke is used to include a variety of morbid conditions, in accordance with the general practice of physicians, as defined by the following quotation from the article on "Sunstroke," contributed by Sir Joseph Fayrer, to the work entitled *A System of Medicine*, edited by T. C. Allbutt:

Under the designation sunstroke, heat stroke, insolation, etc., a variety of morbid conditions, from the simplest to the gravest, are included. However these conditions may be modified by personal susceptibility, local surroundings, and climatic influences, they are essentially due to heat and are the result of direct exposure to the rays of the sun or to a high atmospheric temperature in the shade.

To those unacquainted with medical affairs it may be stated that the general inclination among pathologists is to consider excessive atmospheric heat, natural or artificial, as the chief extrinsic factor in the causation of sunstroke, using the term as above defined. As to the relative importance of the other atmospheric conditions, they are regarded as auxiliaries that may be more efficient at one time than at another, depending upon the physical state of the individual. The particular degree of heat that can be endured without injury or that may be required to produce sunstroke has not been definitely established. Both will depend upon contingencies, which will be mentioned further on.

It is generally accepted that the injurious action of heat is

primarily exerted upon the nervous system to disarrange, in one way or another, the complex and nice adjustments existing between the physiologic processes concerned in the production of heat and the loss of heat. The manifestations of the morbid effects of heat, as seen in sunstroke, may be broadly divided into two categories. In one there is a fall of the temperature of the body below its normal; the skin is pale and cool and covered, more or less, with a clammy perspiration. This is the general class—heat exhaustion or prostration. The other class is characterized by a rise in the temperature of the body above the normal to a state of fever; the skin is usually red, hot, and dry. This is the general condition to which some writers would alone restrict the term sunstroke; it is probably best described as thermic or heat fever. Between these two categories there is no hard and fast line of demarcation, and cases may be seen which present some of the characteristics of each class, or which primarily falling in one category subsequently pass over to the other.

In connection with the following statistics of sunstroke cases and mortality, it should be stated that every effort has been made to avoid duplication of facts, and it is believed that whatever errors, if any, have crept in through this avenue they are too small to vitiate the general result. Perhaps the most serious source of doubt will be found subsisting in the matter of diagnosis; but possible error of diagnosis is a defect inherent to all statistics dealing with disease, and which can not be avoided in the present case any more than in the great number of other cases where statistics are invoked to throw light upon the relation of health to environment.

It must be borne in mind that the meteorologic data, though determined by instruments of precision, can not be assumed to represent all the variations of the weather to which the human being may be subjected in the course of the day, even though both may be in the same neighborhood, because meteorologic instruments are exposed under fixed conditions, whereas man is continually changing his local surroundings, and with each change, either of place or occupation, he alters more or less his meteorologic environment and its effects upon him. It is this difference in the circumstances of exposure that renders it impracticable to state precisely by means of ordinary meteorologic records the atmospheric conditions actually experienced by the living being. The consideration of this, as well as other matters of a more purely physiologic nature, should prepare the reader not to expect to find any attempt made in this paper to give minute details as to the relation between sunstroke and weather.

From such sources as were accessible to the writer there have been collected 2,038 instances of death during August, 1896, directly attributed to sunstroke. This large number of fatal cases was collected as follows: 1,817 deaths reported by health officials of the cities named in Table 1; 207 from newspaper notices and not included in the foregoing; 14 from special reports. Large as this number is it must fall far short of the actual number of victims.

* Extract from Monthly Weather Review, November, 1896.

TABLE 1.—Showing the number of deaths from sunstroke during August, 1896, as reported by the health officials of certain cities.

| Place. | Week ended August— | | | | Month. |
|---------------------------|--------------------|-------|-----|----|--------|
| | 8 | 15 | 22 | 29 | |
| Boston, Mass. | 0 | 64 | 2 | 2 | 66 |
| New York, N. Y. | 11 | 648 | 66 | 1 | 726 |
| Brooklyn, N. Y. | 5 | 215 | 99 | 0 | 319 |
| Philadelphia, Pa. | 6 | 173 | 39 | 0 | 218 |
| Baltimore, Md. | 12 | 78 | 7 | 1 | 98 |
| Washington, D. C. | 7 | 29 | 0 | 0 | 36 |
| Worcester, Mass. | | | | | 4 |
| Rochester, N. Y. | | | | | 2 |
| Buffalo, N. Y. | 1 | 1 | | | 2 |
| Pittsburg, Pa. | 2 | 3 | | | 5 |
| Cincinnati, Ohio | | 10 | 3 | | 13 |
| Columbus, Ohio | 2 | | | | 2 |
| Chicago, Ill. | | | | | 178 |
| Muskegon, Mich. | | 1 | | | 1 |
| Davenport, Iowa | | | 2 | | 2 |
| Keokuk, Iowa | | | 1 | | 1 |
| St. Paul, Minn. | 1 | | | | 1 |
| St. Louis, Mo. | | | | | 132 |
| Chattanooga, Tenn. | | 1 | | | 1 |
| New Orleans, La. | 3 | | 6 | | 9 |
| Phoenix, Ariz. | | 1 | | | 1 |
| Total | 50 | 1,224 | 225 | 2 | 1,817 |
| Add newspapers | | | | | 207 |
| Add special reports | | | | | 14 |
| Total | | | | | 2,038 |

The number of cases of sunstroke that did not end fatally must have been something enormous, but only a limited attempt was made to collect statistics of this class, owing to the difficulty of getting satisfactory data. From information so far received, there have been collected 841 cases of sunstroke treated either in hospitals or in private practice of physicians (see Table 2). Of these 841 cases it appears that 140, or 16.6 per cent, terminated fatally. If this mortality rate be assumed as an index of the general mortality rate from sunstroke, obtaining, in general, during this epidemic, then the 2,038 fatalities would represent the occurrence of 12,277 cases of sunstroke of varying degrees of severity, and even this may be far below the truth.

Tables 2 and 3 show the number of hospital cases and of deaths due to sunstroke on each day. It will be seen from these tables that by far the greater part both of hospital cases and of deaths from sunstroke happened in the New England, Middle Atlantic, and Central States, and upon the 9th, 10th, 11th, 12th, and 13th of August. The period from August 9 to 13 may, therefore, be regarded as having been particularly favorable for the operation of the causes producing sunstroke, and it may perhaps be admissible to speak of the weather during that period as being "sunstroke weather." More than 75 per cent of the hospital cases were admitted during August 9-13, and more than 80 per cent of the sunstroke mortality that could be located by weekly periods occurred during the week August 9-15.

For convenience of reference the region of maximum number of recorded cases of sunstroke may be subdivided into a Coastal Region and an Interior Region, the area included in each region will be sufficiently indicated by the stations that are shown in Tables 2, 3, and 4. These tables show that a few sunstrokes occurred in the interior region on August 3 and in the coastal region on August 4, but that it was not until three or four days later that the number in either region began to assume portentous proportions. The last cases may be virtually said to have occurred on August 15. The weather during the interval, August 3-15, was characterized by intense heat, which became evident in the interior region on the 4th and in the coastal region on the 5th. In both regions the temperature rose from 3° or 4° to 10° or 13° above the normal during the hottest part of the period, which was from the 8th to the 10th in the interior, and from the 9th to the 12th on the coast; it then fell during the following two days in both regions to about the normal. In

both regions the absolute atmospheric humidity was considerably above the average and varied with the temperature, though less rapidly. On the other hand, the relative humidity was subject to frequent fluctuations both above and below the average. The atmospheric pressure was above the average during the entire period. There does not appear to have been anything characteristic about the winds, or the clearness of the atmosphere from what is usual during protracted spells of fair and somewhat rainless weather.

Attention has been called to the interval from August 9 to 12 as the special period of sunstroke occurrence, and as being what the writer has ventured to call "sunstroke weather." Taking this period as affording a promising field for studying the causal relations of meteorologic conditions and sunstroke it would appear that: The daily mean temperatures were highest during this period, being from 10° to 13° above the normal in both regions, or, the average temperature for each of these twenty-four hours equaled or exceeded the normal temperature of the hottest hour of an average August day. The absolute humidity was greatest in both regions during these four days, and the relative humidity was above the average in the interior, but considerably below the average in the coastal region. There does not appear to be any other noticeable or characteristic meteorologic feature of this period.

[As the tables of mean temperature and maximum temperature seem to be more important than those of humidity, wind, and rainfall, therefore, these latter are reluctantly omitted from the present publication.—ED.]

From the given tables it must be concluded:

(a) That the number of sunstrokes follows more closely the excess of the temperature above the normal (see Tables 5 and 6) than it does that of any other meteorologic condition:

(b) That the number of sunstrokes does not appear to sustain any definite relation to the relative humidity, the maximum fatalities having occurred in one region with a relative humidity above the average, and in the other region with a relative humidity decidedly below the average.

(c) That although the absolute humidity was greatest during the maximum of sunstrokes, yet it does not appear that the variations influenced the number of cases.

If it be taken into consideration that the maximum quantity of aqueous vapor in a given space is limited by the temperature of the vapor, and that the relative humidity is really not a simple meteorologic element, but an expression of a ratio that depends on both the aqueous vapor and the temperature, it would seem that the statistics herein collected confirm the proposition that sunstroke is ultimately due to excessive atmospheric temperature. In other words, sunstroke will not occur unless the atmospheric temperature be much greater than that to which the individual is accustomed, no matter what may be the state of the other meteorologic elements.

The important point to be determined from our statistical tables is the atmospheric temperature that will produce sunstroke. Referring again to these tables, it will be observed that, for instance, in the city of Boston a number of people were prostrated and some killed by sunstroke when the mean temperature of the day rose to 82°, or 13° above the August normal; but there were thousands of people living there at the same time that were unhurt by this high temperature as far as can be told; it is, therefore, evident that some people can withstand a higher temperature than others; in other words there is a personal equation to be taken into consideration. Again, it will be seen that while a mean temperature of 82° was fatal or injurious to a large number of people in Boston, yet the same degree of heat is the customary August temperature which the inhabitants of New Orleans endure without sunstroke or any particular inconvenience. Evidently there must enter into the case another factor, namely, the accommodation of the individual to average physical environment, or the climatic equation, and it is apparent therefrom that

TABLE 2.—The daily number of cases of sunstroke admitted to certain hospitals or in the practice of certain physicians from August 1 to 20, inclusive, 1896, together with the resulting mortality.

| Place. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | Total cases. | No. of deaths. | Authority (hospital or physician). | |
|----------------------|---|---|---|----|---|----|----|----|----|-----|-----|-----|-----|----|----|----|----|----|----|----|--------------|----------------|---|--|
| Manchester, N. H. | | | | | | | | | | | 1 | | | | | | | | | | 1 | 1 | Elliot Hospital. | |
| Albany, N. Y. | | | | | | | | 1 | | 4 | 5 | 5 | | | | | | | | | 15 | 3 | Albany Hospital. | |
| Rochester, N. Y. | | | | | | | | 2 | | | | | | 1 | 2 | | | | | | 5 | | Homeopathic Hospital. | |
| Boston, Mass. | | | | | | | | | | 4 | 8 | 18 | 2 | | | 1 | | | | | 33 | 8 | Boston City Hospital. | |
| New Haven, Conn. | | | | | | | | | | 2 | 2 | 4 | 7 | 3 | 2 | | | | | | 20 | 2 | New Haven Hospital. | |
| New York, N. Y. | | | | 2 | 3 | 9 | 5 | 12 | 15 | 49 | 78 | 106 | 64 | 9 | 5 | | | | | | 357 | 62 | Hudson Street, Roosevelt, and New York hospitals. | |
| Brooklyn, N. Y. | | | | | | 2 | 4 | 8 | 5 | 11 | 26 | 32 | 11 | 2 | 2 | | | | | | 103 | 22 | St. John's, St. Mary's, and Brooklyn hospitals. | |
| New Brunswick, N. J. | | | | | | 1 | | | | 1 | | 3 | | | | 2 | | | | | 5 | 2 | Doctors Williamson and Smith. | |
| Philadelphia, Pa. | | | | | 1 | 9 | 11 | 13 | 8 | 22 | 30 | 34 | 21 | 13 | 2 | | | | | | 164 | 16 | St. Agnes, Episcopal, Medico-Chirurgical, and Hahnemann hospitals. | |
| Washington, D. C. | | | | | 1 | 1 | 2 | 3 | 2 | 5 | 1 | 3 | 2 | | 1 | 1 | | | | | 22 | 7 | United States Government Hospital for Insane, Garfield, Providence, and Freedman's hospitals. | |
| Coastal region. | | | | 2 | 5 | 22 | 22 | 39 | 31 | 97 | 154 | 202 | 107 | 28 | 14 | 2 | | | | | | | | |
| Pittsburg, Pa. | | | | | | | | | 1 | | | | 1 | | | | | | | | 2 | 2 | S. S. Hospital. | |
| Cincinnati, Ohio. | | | | 3 | 2 | 2 | 4 | 2 | 8 | 4 | 9 | 7 | | 1 | 2 | 3 | | | | 1 | 48 | 5 | United States Marine Hospital, St. Mary's and Cincinnati hospitals. | |
| Columbus, Ohio. | | | | | | | | | | 1 | | | | | | 1 | | | | | 2 | | St. Francis' Hospital. | |
| Cleveland, Ohio. | | | | | | | | | | 4 | 4 | 1 | | | | | | | | | 2 | | St. Alexis', St. John's, and Huron Street hospitals. | |
| Detroit, Mich. | | | | | | | | | | 1 | | 1 | | | | | | | | | 2 | | United States Marine Hospital. | |
| Holland, Mich. | | | 1 | | | | 1 | | | | | | | | | | | | | | 2 | | Dr. Henry Kremels. | |
| Chicago, Ill. | | | | 2 | 1 | 1 | 1 | 6 | 3 | 1 | 1 | | | | 2 | | | | | | 19 | 4 | St. Luke's, Mercy, and Michael Reese hospitals. | |
| Springfield, Ill. | | | | | 1 | | | | | | | 1 | | | | | | | | | 2 | | City physician, Wabash Emp Hospital. | |
| Louisville, Ky. | | | | 2 | 1 | | 3 | 1 | | 2 | | | | | | | | | | | 9 | | City Hospital. | |
| Cairo, Ill. | | | | | | | | | 1 | | | | | | | | | | | | 1 | | Dr. W. F. Grinstead. | |
| Hannibal, Mo. | | | | | 1 | | | 3 | | | | | 1 | | | | | | | | 5 | 1 | Drs. R. H. Godin, S. Q. Smith, P. L. Kabler. | |
| Columbia, Mo. | | | | | | | | | | | | | | | | | | | | 1 | 1 | | Dr. W. A. Norris. | |
| Kansas City, Mo. | | | | | | | | | 2 | | | | | | 1 | | | | | | 4 | 1 | Drs. W. S. Wheeler, L. A. Berger, C. L. Hall. | |
| Des Moines, Iowa. | | | | | | | | | | | | | | | 1 | | | | | | 1 | | Dr. F. L. Wells. | |
| St. Paul, Minn. | | | | 1 | | | | | 1 | | | | | | | | | | | | 2 | 1 | City and County Hospital. | |
| Interior region | | | 6 | 7 | 4 | 9 | 8 | 16 | 17 | 15 | 11 | 2 | 1 | 6 | 5 | | | | | 1 | 1 | | | |
| Raleigh, N. C. | | | | | | | | | | | | 1 | | | | | | | | | 1 | | Rex Hospital. | |
| Charleston, S. C. | | | | | | | | | | | | | | | | | | | 1 | | 1 | | City Hospital. | |
| Mobile, Ala. | | | | | | | | | | | | | | | | | | | | | 1 | | Dr. J. A. Abrahams. | |
| Dallas, Tex. | | | | 1 | | | | | 1 | | | | | | | | | | | | 3 | | Parkland Hospital. | |
| Palestine, Tex. | 1 | | | | | | | | | | | | | | | | | | | | 1 | 1 | Dr. J. M. Colley. | |
| Grand total | 1 | | 6 | 10 | 9 | 31 | 30 | 56 | 48 | 112 | 166 | 204 | 108 | 34 | 19 | 2 | | 1 | 1 | 3 | 841 | 140 | | |

TABLE 3.—The daily number of deaths from sunstroke occurring in certain regions between August 1 and 20, inclusive, 1896.

| August, 1896. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | Authority. |
|--|------|-----|------|------|---|----|----|----|-----|-----|-----|-----|-----|----|------|----|------|------|------|----|---|
| Coastal region (Massachusetts, Connecticut, Rhode Island, New York, Pennsylvania, Maryland, District of Columbia, and Virginia). | | ... | | | 4 | 11 | 11 | 28 | 107 | 204 | 274 | 264 | 108 | 37 | 5 | 4 | | 2 | 1 | 1 | Newspaper clippings, health officers' re- ports, special reports, physicians and oth- ers. (The information from which this table is compiled is far from complete.) |
| Interior region (Ohio, Kentucky, Tennessee, Indiana, Illinois, Michigan, Wisconsin, Minne- sota, Iowa, Missouri, and Oklahoma). | | 1 | | 5 | 5 | 14 | 16 | 13 | 50 | 100 | 58 | 14 | 3 | 1 | | 2 | 1 | | | 1 | |
| Total: Coastal and Interior regions | | 1 | | 5 | 9 | 25 | 27 | 41 | 157 | 304 | 332 | 278 | 111 | 38 | 5 | 6 | 1 | 2 | 1 | 2 | |

TABLE 5.—The mean temperature of each day at certain selected stations during the sunstroke epidemic of August 3 to 18, inclusive, 1896.

| Place. | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
|-------------------------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| <i>Coastal region.</i> | ° | ° | ° | ° | ° | ° | ° | ° | ° | ° | ° | ° | ° | ° | ° | ° |
| Albany, N. Y. | 72 | 78 | 82 | 83 | 82 | 82 | 82 | 84 | 83 | 82 | 77 | 76 | 75 | 74 | 69 | 64 |
| Boston, Mass. | 71 | 78 | 72 | 65 | 77 | 75 | 82 | 86 | 82 | 82 | 76 | 71 | 67 | 74 | 72 | 68 |
| New Haven, Conn. | 71 | 77 | 80 | 72 | 77 | 81 | 82 | 84 | 83 | 84 | 82 | 74 | 72 | 73 | 69 | 64 |
| New York, N. Y. | 74 | 77 | 80 | 82 | 80 | 82 | 82 | 84 | 85 | 84 | 81 | 75 | 74 | 73 | 68 | 65 |
| Philadelphia, Pa. | 77 | 79 | 82 | 86 | 84 | 86 | 87 | 84 | 87 | 87 | 85 | 77 | 79 | 78 | 74 | 71 |
| Washington, D. C. | 78 | 80 | 83 | 88 | 87 | 84 | 87 | 84 | 84 | 86 | 82 | 78 | 77 | 79 | 73 | 71 |
| <i>Interior region.</i> | | | | | | | | | | | | | | | | |
| Chicago, Ill. | 77 | 82 | 84 | 79 | 77 | 87 | 83 | 86 | 81 | 73 | 72 | 78 | 76 | 72 | 68 | 65 |
| St. Louis, Mo. | 82 | 86 | 88 | 90 | 91 | 91 | 90 | 84 | 86 | 82 | 79 | 81 | 86 | 77 | 72 | 72 |
| Cincinnati, Ohio. | 78 | 78 | 81 | 85 | 76 | 84 | 85 | 84 | 82 | 78 | 80 | 78 | 82 | 76 | 68 | 70 |
| <i>Southern region.</i> | | | | | | | | | | | | | | | | |
| Charleston, S. C. | 84 | 80 | 83 | 82 | 82 | 85 | 87 | 86 | 84 | 82 | 84 | 82 | 80 | 84 | 86 | 80 |
| Jacksonville, Fla. | 86 | 84 | 82 | 83 | 84 | 84 | 86 | 86 | 86 | 84 | 85 | 83 | 84 | 84 | 84 | 86 |
| New Orleans, La. | 82 | 86 | 86 | 84 | 84 | 81 | 78 | 82 | 82 | 86 | 84 | 82 | 80 | 82 | 85 | 87 |
| <i>Western region.</i> | | | | | | | | | | | | | | | | |
| Denver, Colo. | 77 | 78 | 74 | 71 | 74 | 76 | 76 | 74 | 68 | 72 | 77 | 78 | 76 | 74 | 73 | 71 |
| Los Angeles, Cal. | 70 | 70 | 68 | 66 | 70 | 68 | 69 | 68 | 70 | 69 | 71 | 72 | 71 | 74 | 76 | 74 |

the temperature likely to cause sunstroke varies with the climate of the locality; hence, each particular locality has for its native or acclimated inhabitant a special local sunstroke temperature or range of temperature.

As a provisional index to the "sunstroke temperature" of each climate the author proposes the use of the average or normal maximum daily temperature during the warm season of the year, and as a working hypothesis derived therefrom, submits the following proposition: *Sunstroke becomes imminent during the summer months, when the mean temperature of any one day, or of several consecutive days, becomes equal,*

or nearly equal, to the normal maximum temperature for the same period.

The following tabular statement shows the result of the application of this proposition to several of the large cities in the coastal region. The respective columns show:

1. The number of sunstroke cases admitted to the hospitals of the respective cities from the 3d to 18th of August, inclusive.
2. The normal maximum temperature for August.
3. The consecutive dates on which the mean daily temperature for August, 1896, equaled or exceeded the normal maximum for August.

4. The number of sunstroke cases admitted to hospitals during these consecutive dates.

5. The percentage of the cases admitted on these days relative to the total number of cases between August 3-18, inclusive.

| Station. | 1 | 2 | 3 | 4 | 5 |
|-------------------|-----|----|------|-----|--------|
| | | ° | Aug. | | p. ct. |
| Boston..... | 33 | 78 | 9-12 | 30 | 91 |
| New York..... | 357 | 80 | 5-13 | 341 | 96 |
| Philadelphia..... | 164 | 82 | 5-13 | 149 | 91 |
| Washington..... | 22 | 84 | 6-12 | 17 | 77 |

In these special cases, therefore, the approach of the mean daily temperature to the normal maximum temperature was an excellent criterion of impending danger, and it remains for accumulated statistics to show how trustworthy this criterion may be in other cases. In the light of the data here presented for August, 1896, the above rule appears to be an empirical one; but it is based on plausible hypotheses, and can be readily applied; especially is it one that adapts itself easily and naturally to every climate, and therefore embodies at least a part of what we have called the climatic equation. As enunciated above, it has the merit of expressing a relation with considerable precision, that may be expressed in other words as follows: The liability to sunstroke increases in proportion as the mean temperature of the day approaches the normal maximum temperature for that day.

In addition to the influence of heat, the statistics furnished by the hospitals and physicians enable us to determine approximately the general influence of personal habits, and of nationality and other peculiarities. For instance, of the 841 cases collected in Table 4, the history of 465 as to the use of alcoholic drinks is given as follows:

| | | |
|-----------------------|---------------|--------------|
| Using to excess..... | 140 cases, or | 30 per cent. |
| Using moderately..... | 230 “ | 50 “ |
| Using not at all..... | 95 “ | 20 “ |
| Total..... | 465 “ | 100 “ |
| History unknown..... | 376 | |
| Total..... | 841 | |

If the 140 deaths that occurred in these 841 cases be similarly classified, the resulting figures are:

| | | |
|-----------------------|---------------|--------------|
| Using to excess..... | 41 deaths, or | 60 per cent. |
| Using moderately..... | 22 “ | 30 “ |
| Using not all..... | 7 “ | 10 “ |
| Total..... | 70 “ | 100 “ |
| History unknown..... | 70 | |
| Total..... | 140 | |

If these facts teach anything it is that the use of alcoholic beverages in hot weather is to be reprobated most strenuously.

Table 4 shows some interesting facts as to the nationalities that contributed to these 841 cases, but it would not be safe to argue much as to the relative liability of any nationality to sunstroke unless we could first compare these numbers with the general distribution of population by nationalities. One item gathered from the reports, but not shown by this table, is that only 15 of these cases were colored people, and the mortality among them was 2. As to sex, 100 cases were females. So far as occupation was concerned all walks of life were represented, but the greater number of cases occurred among those engaged in occupations apparently requiring physical rather than intellectual effort.

TABLE 4.—The 841 cases of sunstroke reported from hospitals or private practice, arranged according to nativity and fatality

| Nativity. | Number reported. | Deaths. | Nativity. | Number reported. | Deaths. |
|------------------------|------------------|---------|--------------------|------------------|---------|
| United States..... | 340 | 37 | Austria..... | 5 | 2 |
| Ireland..... | 253 | 44 | Denmark..... | 2 | 1 |
| Germany..... | 123 | 24 | Belgium..... | 1 | 1 |
| England..... | 32 | 5 | South America..... | 2 | 0 |
| Italy..... | 14 | 0 | Spain..... | 1 | 0 |
| France..... | 10 | 5 | Holland..... | 1 | 1 |
| Canada..... | 8 | 3 | Australia..... | 1 | 0 |
| Norway and Sweden..... | 10 | 5 | Armenia..... | 1 | 0 |
| Russia..... | 7 | 0 | Greece..... | 1 | 0 |
| Poland..... | 6 | 0 | Unknown..... | 15 | 12 |
| Scotland..... | 5 | 0 | | | |
| Switzerland..... | 3 | 0 | Total..... | 841 | 140 |

TABLE 6.—The departure of the daily mean temperature from the normal at certain stations from August 3 to 18 inclusive, 1896.

| Place. | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
|------------------------|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|----|----|----|----|----|
| Albany, N. Y..... | 0 | +6 | +10 | +11 | +10 | +10 | +11 | +13 | +12 | +11 | +6 | +5 | +4 | +3 | -2 | -7 |
| Boston, Mass..... | +1 | +8 | +2 | -5 | +7 | +5 | +13 | +17 | +13 | +13 | +7 | +2 | -2 | +5 | +3 | -1 |
| New Haven Conn..... | +1 | +7 | +10 | +2 | +7 | +11 | +13 | +15 | +14 | +15 | +13 | +5 | +3 | +4 | 0 | -5 |
| New York, N. Y..... | +1 | +4 | +7 | +9 | +7 | +9 | +10 | +12 | +13 | +12 | +9 | +3 | +2 | +1 | -4 | -7 |
| Philadelphia, Pa..... | +3 | +4 | +6 | +10 | +10 | +11 | +11 | +8 | +12 | +12 | +10 | +3 | +5 | +4 | -1 | -2 |
| Washington, D. C..... | +3 | +5 | +8 | +13 | +12 | +9 | +13 | +10 | +10 | +12 | +8 | +4 | +3 | +5 | -1 | -3 |
| Chicago, Ill..... | +5 | +10 | +13 | +8 | +5 | +15 | +12 | +16 | +9 | +1 | +1 | +8 | +6 | +2 | -6 | -7 |
| St. Louis, Mo..... | +4 | +9 | +11 | +12 | +13 | +13 | +12 | +5 | +8 | +4 | +1 | +3 | +8 | -1 | -6 | -6 |
| Cincinnati, Ohio..... | +2 | +2 | +5 | +9 | 0 | +8 | +10 | +9 | +7 | +3 | +5 | +3 | +7 | +1 | -7 | -5 |
| Charleston, S. C..... | +3 | -1 | +2 | +1 | +1 | +4 | +7 | +6 | +4 | +2 | +4 | +2 | 0 | +4 | +6 | 0 |
| Jacksonville, Fla..... | +4 | +2 | 0 | +1 | +2 | +2 | +4 | +4 | +4 | +2 | +3 | +1 | +2 | +2 | +2 | +4 |
| New Orleans, La..... | 0 | +4 | +4 | +2 | +2 | -1 | -4 | 0 | 0 | +4 | +2 | 0 | -2 | 0 | +3 | +5 |
| Denver, Colo..... | +5 | +6 | +3 | 0 | +3 | +5 | +5 | +3 | -3 | +1 | +7 | +8 | +6 | +4 | +3 | +1 |
| Los Angeles, Cal..... | -2 | -2 | -4 | -6 | -3 | -5 | -4 | -5 | -3 | -4 | -2 | -2 | -3 | 0 | +3 | +1 |

TABLE 7.—The departure of the daily maximum temperature from the normal August maximum at certain stations from August 3 to 18, inclusive, 1896.

| Place. | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | Normal max. |
|------------------------|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|----|-----|----|----|----|-------------|
| Boston, Mass..... | +3 | +12 | +2 | -9 | +12 | +2 | +14 | +17 | +11 | +11 | +3 | -3 | -8 | +5 | +1 | 0 | 78 |
| New York, N. Y..... | +1 | +7 | +9 | +11 | +11 | +12 | +10 | +11 | +14 | +12 | +8 | 0 | -1 | +3 | +6 | -7 | 80 |
| Philadelphia, Pa..... | +6 | +8 | +12 | +14 | +13 | +14 | +14 | +11 | +15 | +15 | +12 | 0 | +5 | +6 | -4 | -2 | 82 |
| Washington, D. C..... | +2 | +7 | +12 | +14 | +13 | +9 | +13 | +9 | +10 | +12 | +11 | +1 | +2 | +4 | -3 | -4 | 84 |
| Chicago, Ill..... | +8 | +16 | +17 | +7 | +4 | +20 | +15 | +15 | +14 | -2 | -3 | +7 | +5 | -3 | -8 | -8 | 78 |
| St. Louis, Mo..... | +6 | +11 | +12 | +13 | +14 | +14 | +13 | +5 | +11 | +8 | +3 | +2 | +11 | -1 | -9 | -7 | 86 |
| Cincinnati, Ohio..... | +2 | +5 | +8 | +12 | -2 | +10 | +10 | +9 | +9 | +1 | +4 | +2 | +6 | -2 | -7 | -6 | 84 |
| Charleston, S. C..... | +8 | -1 | +1 | 0 | +1 | +5 | +8 | +5 | +4 | +1 | +3 | +2 | 0 | +2 | +6 | +3 | 87 |
| Jacksonville, Fla..... | +5 | +6 | +2 | 0 | +2 | +2 | +5 | +5 | +6 | +3 | +4 | +5 | +3 | +2 | +3 | +6 | 90 |
| New Orleans, La..... | +2 | +6 | +8 | +4 | +4 | 0 | -1 | +2 | +2 | +6 | +5 | +1 | -3 | +2 | +5 | +7 | 88 |